VAV adjustment and diagnostic tool with PP interface for Belimo VAV controllers. Connection via

- **Service socket on VAV controller**
- **MP/PP interface**
- **Control cabinet**

Technical data

Electrical data	Nominal voltage		From VAV controller, AC 24 V, 50/60 Hz / DC 24 V
	Power supply range of VAV controller		AC 19.2 ... 28.8 V / DC 21.6 ... 28.8 V
	Power consumption	In operation	1 W
		For wire sizing	2 VA
Connection	Plug socket for Belimo PP interface		RJ12 socket
	Connecting cable		See page 6
MP/PP interface	Communication		PP, no MP operation
VAV controllers	VAV-Universal		VRD2, VRD3, VRP-M (VAV & STP)
	VAV-Compact		NMV-D2, LMV-D2M, NMV-D2M LMV-D2-MP, NMV-D2-MP, SMV-D2-MP, LHV-D2-MP LMV-D2LON, NMV-D2LON
Operation	LC display		2 x 16 characters with backlighting
	Buttons		▼ / ▲ / – / + / OK
	Quick start guide		Included, en/de
Safety / tests	Protection class		**III** Safety extra-low voltage
	EMC		CE according to 89/336/EEC
	Operating temperature		0 ... 50 °C, non-condensing
	Storage conditions		–20 ... 50 °C, non-condensing
Dimensions / weight	Dimensions		See page 8
	Weight		Approx. 260 g

Safety notes

- **The device is not allowed to be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.**
- **Only suitable for connection to Belimo VAV devices with 24 V safety extra-low voltage and a PP/MP interface.**

Brief description

Applications

The ZTH-VAV adjustment tool enables VAV and CAV systems to be tested efficiently. Systems equipped with Belimo VAV controllers can be easily adjusted to individual room and user requirements.

Can be used with:	**available since:**
VAV-Universal VRD2, VRD2-L	1992–2007
VAV-Universal VRD3 [1)]	from 2008
VAV-Universal VRP-M [VAV and STP (pressure application)]	from 2005
VAV-Compact NMV-D2	1992–2000
VAV-Compact LMV-D2M, NMV-D2M	2000–2006
VAV-Compact LMV-D2-MP, NMV-D2-MP, SMV-D2-MP, LHV-D2-MP	2006
VAV-Compact LMV-D2LON, NMV-D2LON	2006

[1)] Requires ZTH-VAV Firmware V1.02 or higher

Brief description

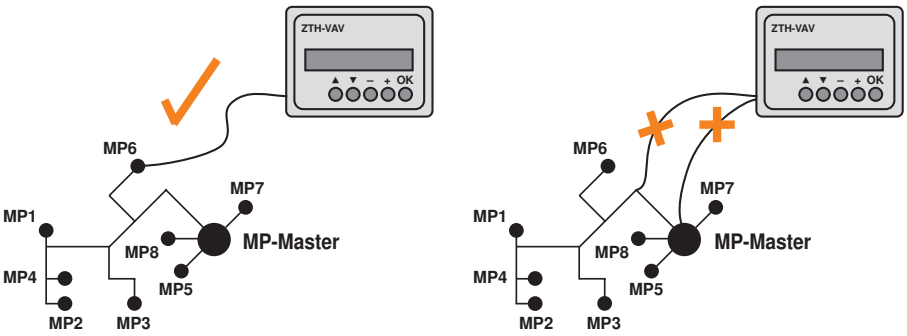
(Continued)

Connection and supply

Stand-alone operation:
The tool can be connected and supplied using the service socket on the VAV controller or the connecting terminals.

Bus operation:
If the ZTH-VAV is connected to the local service socket, it can be used to test the following devices without interrupting the bus: VAV-Compact L/N/SMV-D2-MP and L/NMV-D2LON.
The MP-Bus must be disconnected in order to test the VRP-M and L/NMV-D2M when the service socket is used.

Limitation
The tool cannot be directly connected in an MP network or via an MP-Bus master.



Operating instructions

These operating instructions describe handling of the ZTH-VAV adjustment tool. For a detailed description of VAV controllers, please refer to the separate product documentation, which can be downloaded from www.belimo.eu ¦ Documentation ¦ Room & System Solutions.
A quick start guide in English and German is included with the ZTH-VAV as a sticker that can be affixed to the rear of the device.

Compatibility

The ZTH-VAV adjustment tool supersedes the old ZEV adjustment tool (1992–2007).
All standard Belimo VAV controllers with integrated PP communication that are sold in EU countries (from 1992) can be adjusted using the ZTH-VAV.
Belimo Automation AG reserves the right to make changes or improvements at any time without prior notice. The latest version of these operating instructions is published on our website: www.belimo.eu.

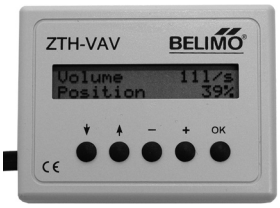
Connection

See page 6.

Operation

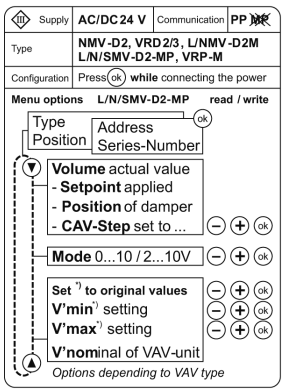
Buttons, display

RJ12 connection:
PP / 24 V
See page 6



LC display, 2 x 16 characters with backlighting
▼▲ Scroll up / down, cancel
– + Change value
OK Confirm

Device rear, quick start guide



A quick start guide in English and German is included with the ZTH-VAV as a sticker that can be affixed to the rear of the device.
Contents:
– Connection
– Overview of types
– Access to Configuration menu
– Operating menu with navigation tree

Operation *(Continued)*

Configuration menu

You can set the language and the volumetric flow units in the Configuration menu.
The settings are stored.

Start Configuration menu	
Action:	Keep the (OK) button pressed while you connect the tool to the VAV controller.
Reaction:	«Configuration menu» appears on the display
Continue with:	(▼ ▲) buttons
Exit:	Menu option «leave config-menu» or disconnect cable

Options

Text	**German** * / English	
Units	**m³/h** *, l/s, cfm	
Supply	AC 24 V	AV 24 V voltage indication, refer to page 7 for an explanation
MP tester	MP-Bus level tester	MP-Bus diagnostic tool for system integrators The MP tester is not included in this documentation.
Expert Mode	**0** */ 1	Activates mode switching, Restores original $\dot{V}_{min}$ / $\dot{V}_{max}$ values
Advanced Mode	**0** */ 1	Activates the direction-of-rotation setting

* Default

Operating menu – overview

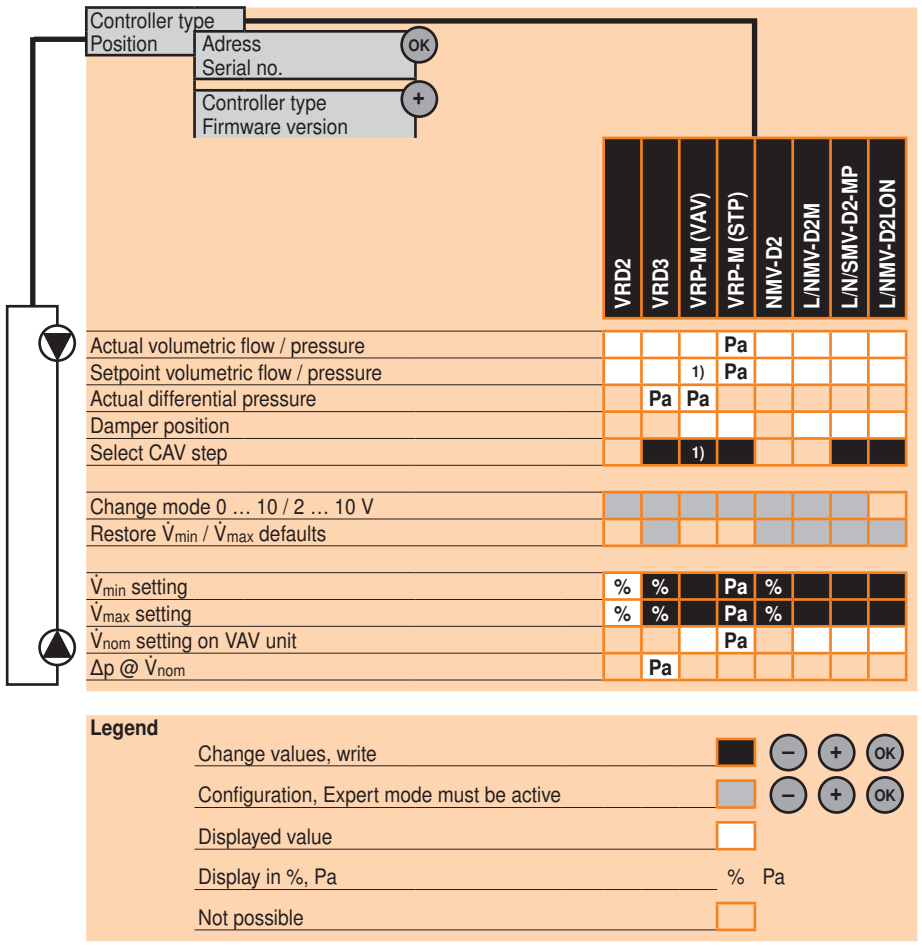
The operating menu adapts to the functionality of the connected VAV controller. Options that are not relevant are not shown.

Device ID

VAV controller

Menu

Explanation



1) only with VRP-M V3.x

Operation

(Continued)

Device identification (Read only)

As soon as the ZTH-VAV is connected to a VAV controller, the display shows the version number and then a device ID containing the following information:

- **Type** Type of the connected VAV controller, e.g. LMV-D2-MP
- **Position** Text string programmed with the PC-Tool, e.g. system designation

Note
Only characters in the ISO-8859-1 character table are supported.

Press (OK) to display the following additional information:

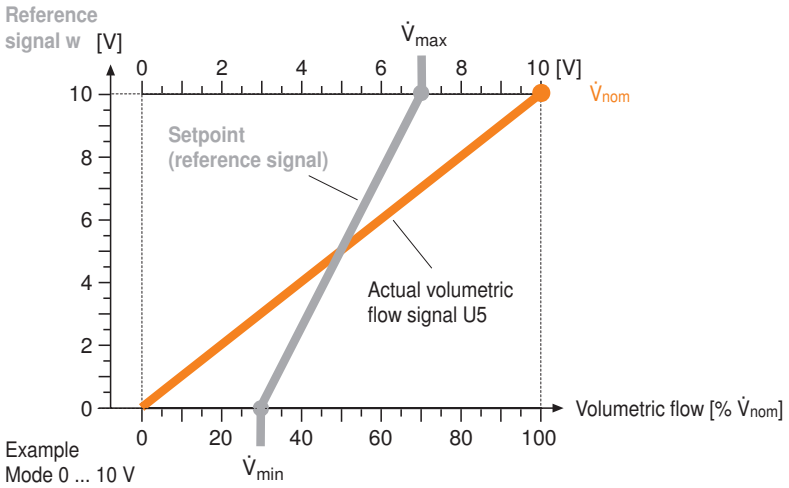
- **Adress** PP or MP1...8 (no addresses are supported by VRD2 / NMV-D2; display: ?)
- **Serial no.** Unique, 16-character serial number

Press (+) to display the firmware version in addition to the type. This function is not supported by the NMV-D2 or VRD2.

Functions

Actual volumetric flow (read only)

($0 \ldots 100\ \% \dot{V}_{nom}$)

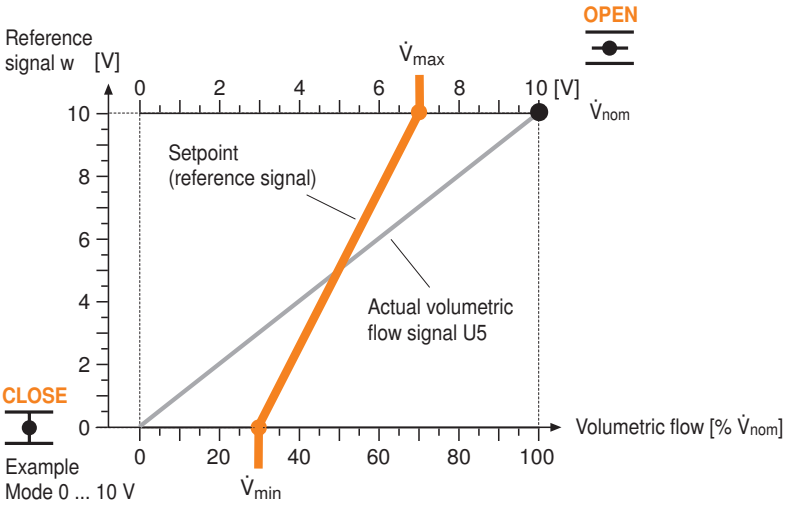


Note
For a detailed description of these functions, please refer to the separate documentation for the VAV controllers concerned.
Visit www.belimo.com or contact your local Belimo representative.

The volumetric flow is indicated relative to the $\dot{V}_{nom}$ setting.

Setpoint (Read only)

(CLOSE, $\dot{V}_{min} \ldots \dot{V}_{max}$, OPEN)



The setpoint setting range corresponds to $\dot{V}_{min} \ldots \dot{V}_{max}$. If a local override function is active, e.g. NMV-D2-MP: CLOSE damper (jumper 1–3), this information is shown with the setpoint.

The pressure is shown instead of the volumetric flow for the VRP-M [STP], in other words a room or air duct pressure application. P_{nom}, P_{min}, P_{max} appear in place of $\dot{V}_{nom}$, $\dot{V}_{min}$, $\dot{V}_{max}$.

Pressure (Read only)

The volumetric flow and the differential pressure at the sensor [Pa] are shown for the VRD3 and the VRP-M.

Functions

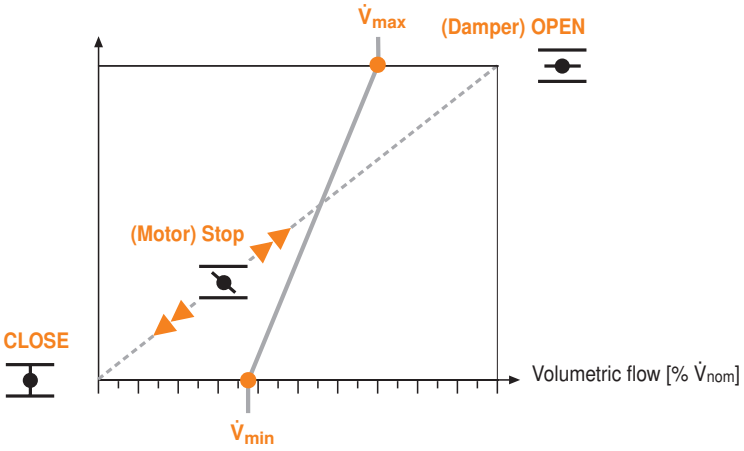
(Continued)

Damper position [0 … 100 %]
(Read only)

The position is shown in the following cases:
– Synchronisation, adaption: 0%.
– VAV controller without position feedback [1] 0%

[1] VRD2, VRD3, VRP-M with NM24-V-ST)

Select CAV step
[AUTO / CLOSE / OPEN / $\dot{V}_{min}$ / $\dot{V}_{max}$ / STOP]
(Read / write)



The CAV steps shown opposite, also referred to as operating modes, can be used to test VAV / CAV units for L/N/SMV-D2-MP, L/NMV-D2LON, VRD3 and VRP-M. By activating a CAV step, you set the VAV controller to a fixed operating mode. The temporarily selected volumetric flow setpoint is indicated in the setpoint display. If the ZTH-VAV is disconnected from the VAV controller, the controller is reset to automatic mode (control function) within two minutes.

The following operating modes are available

Step	Function	Control function	Available with
AUTO	Setpoint of input 3 (w/y) or MP master active	VAV or CAV mode	VRD3, VRP-M xMV-D2-MP xMV-D2LON
CLOSE	Damper closes	No control mode	
OPEN	Damper opens	No control mode	
$\dot{V}_{min}$	Controller operates with volumetric flow $\dot{V}_{min}$	CAV mode $\dot{V}_{min}$	
$\dot{V}_{max}$	Controller operates with volumetric flow $\dot{V}_{max}$	CAV mode $\dot{V}_{max}$	
STOP	Damper stops in current position	No control mode	

Change mode [0 … 10 / 2 … 10 V]
(Read only)

The mode function can be used to adapt the setpoint input and the actual value output signal to the application or controller.

Note:
By changing the mode, you change the operating behaviour of the VAV controller. The mode should therefore only be changed if absolutely necessary and only by suitably trained personnel.

Restore $\dot{V}_{min}$/$\dot{V}_{max}$ defaults
[yes / no]
(Write)

The original $\dot{V}_{min}$/$\dot{V}_{max}$ values set by the unit manufacturer (OEM) are restored.
All values set in the meantime are overwritten by the original values.

Operating volumetric flow $\dot{V}_{min}$
[0 … 100 % $\dot{V}_{nom}$]
(Read / write)

$\dot{V}_{min}$ input in percent [$\dot{V}_{nom}$ setting 0 m³/h, l/s] for
– Old VAV devices [1]: as a percentage of $\dot{V}_{max}$
– New VAV devices [2]: as a percentage of $\dot{V}_{nom}$
The ZTH-VAV detects the $\dot{V}_{min}$ reference of the connected controller and displays it accordingly.
[1] VRD2, VRP-M up to V2.16, NMV-D2, L/NMV-D2M
[2] VRD3, VRP-M from V3.x, L/N/SMV-D2-MP, L/NMV-D2LON

Note
In order to change the $\dot{V}_{min}$/$\dot{V}_{max}$ setting of a VRD3, both potentiometers must be in the Tool position. If this is not the case, it is only possible to display the parameters with the ZTH-VRD3. Refer to the VRD3 product documentation, www.belimo.com.

Minimum setting limit *) Oversizing of the VAV units can make control more difficult in the lowest differential pressure range. A minimum volumetric flow, usually corresponding to a differential pressure of ~2 ... 5 Pa, is therefore specified for these units by the manufacturer. Functional restrictions in this range can be avoided by complying with the unit manufacturer's volumetric flow setting.

$\dot{V}_{min}$ setting 0 m³/h or 0% If the damper needs to be shut off by means of a 0.0 V setpoint signal in VAV mode, this can be achieved by setting $\dot{V}_{min}$ 0 m³/h or 0 %.

Operating volumetric flow $\dot{V}_{max}$
[30 … 100 % $\dot{V}_{nom}$]
(Read / write)

Functions

(Continued)

$\dot{V}_{nom}$ setting on the VAV unit (Read only)

When the VAV unit is calibrated, the unit manufacturer stores a displayed value in m³/h or l/s for the differential pressure at $\dot{V}_{nom}$. This value is used to indicate the actual volumetric flow on a display unit or on the higher-level control system of a bus system.

Note
The VRD2, VRD3 and NMV-D2 do not support the display of $\dot{V}_{nom}$ as absolut value. $\dot{V}_{nom}$ equals to 100%.

If no displayed value for $\dot{V}_{nom}$ is stored for the VAV controller (ZTH-VAV ¦ $\dot{V}_{nom}$: 100%), the operating volumetric flow values $\dot{V}_{min}$ and $\dot{V}_{max}$ are shown and entered in percent.

Δp @ $\dot{V}_{nom}$ (Read only)

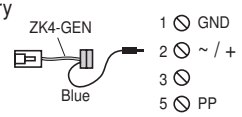
This parameter describes the pressure difference (Pa) at nominal volumetric flow $\dot{V}_{nom}$, measured to the D3 sensor.
The Δp @ $\dot{V}_{nom}$ parameter is set by the VAV unit manufacturer when the unit is calibrated and cannot be altered by the user.

VAV-Compact L/N/SMV-D2-MP: «Open Loop» mode

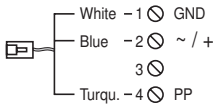
If a VAV-Compact is programmed as an open-loop controller, VAV control is deactivated. In this case, the Compact device acts as a remote actuator and sensor unit for an external VAV controller.
– The actual volumetric flow and the damper position are indicated correctly.
– It only makes sense to display the setpoint in this application, however, if $\dot{V}_{nom}$ is set to 0 m³/h or l/s, i.e. display ZTH-VAV ¦ $\dot{V}_{nom}$: 100%.

Connection

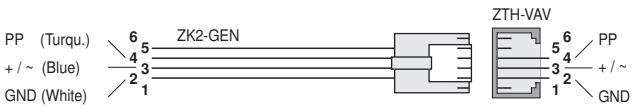
Local service socket

Connection to	Cable type and order designation	
L/N/SMV-D2-MP	ZK1-GEN	Included with ZTH-VAV
L/NMV-D2LON		
L/NMV-D2M, CR24	ZK1-VAV	Accessory
VRP-M	ZK4-GEN	Accessory 
VRD3	ZK6-GEN	Accessory

Connecting terminals

Connection to	Cable type and order designation	
L/N/SMV-D2-MP	ZK2-GEN	
L/NMV-D2LON		
L/NMV-D2M		
NMV-D2, VRD2		
VRD3, VRP-M		

ZK2-GEN wiring assignment



Supply voltage test for VAV controllers (AC/DC 24 V)

Safety notes

The ZTH-VAV must only be used to test AC 24 V supply voltages (**III** safety extra-low voltage) downstream of a safety isolation transformer. The measurement/use for this purpose is only permitted in conjunction with a Belimo VAV controller.
All other forms of use are prohibited!

Maximum measuring voltage

Maximum measuring voltage AC 30 V / DC 42 V. Higher voltage levels are liable to damage the device beyond repair!

The ZTH-VAV can be used to test the AC 24 V supply voltage of the VAV controllers in conjunction with the ZK2-GEN connecting cable.

Measuring the AC 24 V supply voltage with the ZTH-VAV helps pinpoint the cause of a malfunction, e.g. when the system is started up.

To test the supply voltage

Equipment: ZTH-VAV, ZK2-GEN

Connection:
– Connect the free wires of the ZK2-GEN to AC 24 V.
  • White to GND (terminal 1 on the VAV controller)
  • Blue to ~ (terminal 2 on the VAV controller)
  • Do not connect the third wire (turquoise)
– Do not connect the RJ11 plug to the ZTH-VAV for the time being!

Start:
– Keep the (OK) button pressed while you connect the ZTH-VAV to the VAV controller
– Using the arrow key (▼) select «Supply»

Exit: Disconnect the ZTH-VAV from the VAV controller or select «leave config-menu» (Set)

Display format

Supply		okay
AC 24 V	VHW:	88%

— Supply voltage quality
— Half-wave ratio (only indicated for AC 24 V)
— Measured AC or DC value in volts

AC voltage (AC 24 V)

Supply		okay
AC 25 V	VHW:	88%

Quality: okay: AC supply in the range from 19.2 to 28.8 V
AC value: Measured AC voltage (accuracy: ±1.0 V, if VHW >95%)
VHW: Ratio of the positive half-wave to the negative half-wave

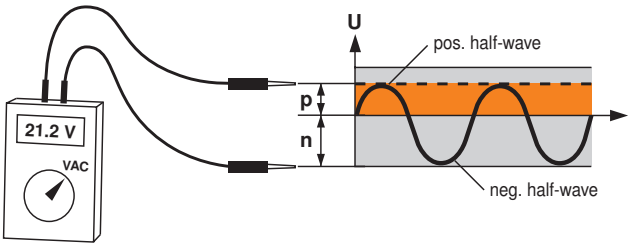
The difference between the positive half-wave value and the negative half-wave value must not be too large.
Rule of thumb: Pos. HW / neg. HW x 100 must not be >80%.

AC 24 V supply

In practice, most field and control devices use half-wave rectifiers for their internal supply voltage.
- Advantage: Straightforward wiring and connections.
- Disadvantage: Only the positive half-wave is loaded.

Standard voltmeters always indicate the effective value for both half-waves.
The determining value for each of the two half-waves can only be indicated on an oscilloscope or the ZTH.

Explanation of VHW



Potential problems

The half-wave load is influenced if:
- The transformer is too small
- The cable between the transformer and the VAV controller is too long

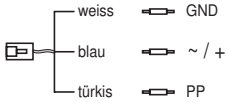
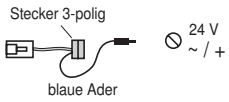
DC voltage (DC 24 V)

A voltmeter should be used to test a DC 24 V installation.

Restriction

The supply voltage cannot be tested if the ZTH-VAV is connected to the service socket of the VAV or CR24 controller (transformed DC voltage).

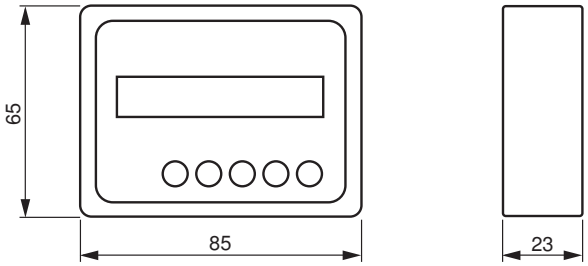
Accessories

Cable type and order designation		Compatible with	Remarks
ZK1-GEN		• LMV-D2-MP, LHV-D2-MP • NMV-D2-MP • SMV-D2-MP • LMV-D2LON, NMV-D2LON	Included with ZTH-VAV
ZK1-VAV		• LMV-D2M • NMV-D2M • CR24-B1/B2/B3	1)
ZK2-GEN		All VAV controllers connected via connecting terminals	1) 
ZK4-GEN		VRP-M	1) 
ZK6-GEN		VRD3	1)

1) Available as accessories

Dimensions [mm]

Dimensional diagrams



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